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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/671,324	**Applicant(s)** PRAKASH ET AL.	
	Examiner DOUGLAS C. GODBOLD	**Art Unit** 2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 09 January 2008.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1,3-12 and 14-33 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) 11 and 20 is/are allowed.

6)☒ Claim(s) 1,3-10,12,14-19 and 21-33 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to correspondence filed January 9, 2008 in reference to application 10,671,324. Claims 1, 3-12, and 14-33 are pending in the application and have been examined.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 9, 2008 has been entered.

Response to Amendment

3. The amendment filed January 9, 2007 has been considered and accepted in this office action. Claims 7 and 14 have been amended, and claims 2 and 13 have been cancelled. As a result, the objections of claims 7 and 13 have been withdrawn.

Response to Arguments

4. Applicant's arguments filed January 9, 2008 have been fully considered but they are not persuasive.

5. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., see Remarks, page 9, that the prior art does not teach the feature of the invention which divides band energy over the sum of band energies in order to determine energy ratios, and also that the invention is not an iterative process) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). The former limitation appears in claim 14, however the limitations of a dependent claim cannot be read into parent claims nor into unrelated claims.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1, 3-10, 12-19, and 21-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Davidson et al (US Patent 6,246,345) in view of Hu et al (US Patent 6,745,162).

8. Consider claim 1, Davidson teaches a method for real-time encoding of an audio signal (using system if figure 1.) comprising:

grouping spectral lines to form scale band factors (gains 15 and 25, figure 1) by determining masking thresholds based on human perception system (In figure 1, analysis filter bank 12 receives an input signal from path 11, splits the input signal into subband signals representing frequency sub-bands of the input signal... it is common for a split-band encoder and decoder in a perceptual coding system to process many more sub-bands having bandwidths that are commensurate with the critical bandwidths of the human auditory system; column 4, line 30-39. The use of the Fourier transform implies grouping the Fourier transform spectral lines to obtain critical bands);

shaping quantization noise in spectral lines in each scale band factor (Figure 3, step 51 applies a perceptual model to information representing characteristics of the input signal to establish a desired quantization-noise spectrum, column 5, line 20. Subband-signal components are passed to gain element 15 and 25 which apply these scale band factors obtained by analyzer 14; column 6, line 13); and

running a loop for each scale band factor to satisfy a predetermined bit allocation rate based on a bit allocation scheme (implied by figure 3 showing a loop for allocating bits to satisfy a noise spectrum).

However Davidson does not specifically teach shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios.

In the same field of bit allocation, Hu teaches shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios (In step 412, psycho-acoustic modeler 126 determines signal to mask ratios for the filtered source audio data, and then provides the signal to mask ratios to bit allocator 122; column 5, line 25. In step 416, bit allocator 122 advances to a new current frame. At step 417 the .DELTA.SMR is calculated for each sub-band. This value compares is the difference in SMR for a sub-band as compared to the SMR value for that sub-band in a prior iteration of the loop containing step 417. The sub-band index is advanced at step 418 so that processing of the next (or first) sub-band takes place; column 5 line 42. This step of comparing the change in SMR's is in fact comparing energy levels, as the SMR is determined in part by the energy levels.).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the bit allocation technique taught by Hu, with the audio encoder of Davidson in order to provide a quantization allocation that more accurately takes advantage of the human perceptual model in order to hide quantization noise more effectively.

9. Consider claim 3, Davidson teaches the method of claim 2, but does not specifically teach wherein shaping the quantization noise in the spectral lines by assigning precision based on band energy ratios and SMRs comprises:

shaping the quantization noise in each scale band factor such that a difference between SMR and SNR in each scale band factor is substantially constant.

However the allocation of figure 3, shows modifying resolution until the noise spectrum is just below the mask threshold for the subband. If this loop is run for each subband, every subband will have a noise spectrum just below the mask threshold, so that the SMR and the SNR are substantially constant for each band.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to make the SMR and the SNR substantially constant in order to provide an efficient encoding scheme, not wasting unnecessary bits to create noise to mask ratios that are unnecessarily large.

10. Consider claim 4, Davidson teaches the method of claim 3, but does not specifically teach wherein shaping the quantization noise in each scale band factor such that the difference between SMR and SNR is substantially constant comprises:

assigning a higher quantization precision to scale band factors having a high SMR; and

assigning a quantization precision to each scale band factor that is inversely in proportion to their energy content with respect to frame energy to desensitize the scale factor bands.

However, assigning a higher quantization precision to scale band factors having a high SMR and assigning a quantization precision to each scale band factor that is inversely in proportion to their energy content with respect to frame energy to desensitize the scale factor bands would have been obvious to one or ordinary skill in

the art as there is an obvious tradeoff between emphasizing the audibility of weak bands and the emphasizing the accuracy of strong band signals.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to assign quantization precision based one the signal to mask ratio in order to emphasize bands that might have otherwise been lost is quantization.

11. Consider claim 5, Davidson teaches a single-loop (figure 3 shows a loop for allocating bits to satisfy a noise spectrum) quantization method for band-by-band system (In FIG. 1, analysis filter bank 12 receives an input signal from path 11, splits the input signal into subband signals representing frequency sub-bands of the input signal; column 4 line 30) comprising:

calculating local gain for each band (Subband-signal components are passed to gain element 15 which applies gain factor obtained by analyzer 14; column 6, line 13); and

coding of an audio signal comprising shaping quantization noise in each band (Figure 3, step 51 applies a perceptual model to information representing characteristics of the input signal to establish a desired quantization-noise spectrum; column 5, line 20. Subband-signal components are passed to gain element 15 which applies gain factor obtained by analyzer 14; column 6, line 13).

However Davidson does not specifically teach shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios.

In the same field of bit allocation, Hu teaches shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios (In step 412, psycho-acoustic modeler 126 determines signal to mask ratios for the filtered source audio data, and then provides the signal to mask ratios to bit allocator 122; column 5, line 25. In step 416, bit allocator 122 advances to a new current frame. At step 417 the .DELTA.SMR is calculated for each sub-band. This value compares is the difference in SMR for a sub-band as compared to the SMR value for that sub-band in a prior iteration of the loop containing step 417. The sub-band index is advanced at step 418 so that processing of the next (or first) sub-band takes place; column 5 line 42. This step of comparing the change in SMR's is in fact comparing energy levels, as the SMR is determined in part by the energy levels.).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the bit allocation technique taught by Hu, with the audio encoder of Davidson in order to provide a quantization allocation that more accurately takes advantage of the human perceptual model in order to hide quantization noise more effectively.

12. Consider claim 6, Davidson teaches the method of claim 5, wherein shaping the quantization noise in each band using its local gain comprises:

shaping the quantization noise in each band by setting a scale factor in each band based on its psychoacoustic parameters and energy ratio (According to this method, step 51 applies a perceptual model to information representing characteristics

of the input signal to establish a desired quantization-noise spectrum. The noise levels in this spectrum correspond to the estimated psychoacoustic mask threshold of the input signal; column 5 line 18-24.).

13. Consider claim 7, Davidson teaches the method of claim 5,but does not specifically teach wherein shaping quantization noise in each band by assigning quantization precision based on band energy rations and SMRs comprises:

shaping quantization noise in the spectral lines in each band such that a difference between Signal-to-Mask Ratio (SMR) and Signal-to-Noise Ratio (SNR) in each band is substantially constant.

However the allocation of figure 3, shows modifying resolution until the noise spectrum is just below the mask threshold for the subband. If this loop is run for each subband, every subband will have a noise spectrum just below the mask threshold, so that the SMR and the SNR are substantially constant for each band.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to make the SMR and the SNR substantially constant in order to provide an efficient encoding scheme, not wasting unnecessary bits to create noise to mask ratios that are unnecessarily large.

14. Consider claim 8, Davidson teaches the method of claim 7, wherein the spectral lines are derived by performing a time to frequency transformation of the audio signal (Analysis filter bank 12 may be implemented in a wide variety of ways including

polyphase filters, lattice filters, the quadrature mirror filter (QMF), various time-domain-to-frequency-domain block transforms including Fourier-series type transforms, cosine-modulated filter bank transforms and wavelet transforms; column 4 line 40.).

15. Consider claim 9, Davidson teaches the method of claim 7, further comprising:

partitioning the audio signal into a sequence of successive frames (In preferred embodiments, the bank of filters is implemented by weighting or modulating overlapped blocks of digital audio samples with an analysis window function; column 4, line 45);

forming bands including groups of neighboring spectral lines for each frame based on critical bands of hearing (In FIG. 1, analysis filter bank 12 receives an input signal from path 11, splits the input signal into subband signals representing frequency sub-bands of the input signal... it is common for a split-band encoder and decoder in a perceptual coding system to process many more sub-bands having bandwidths that are commensurate with the critical bandwidths of the human auditory system; column 4, line 30-39); and

computing local gain for each band (Subband-signal components are passed to gain element 15 which applies gain factor obtained by analyzer 14; column 6, line 13).

16. Consider claim 10, Davidson teaches the method of claim 7, but does not specifically teach wherein shaping quantization noise in each band such that the difference between SMR and SNR is substantially constant comprises:

assigning a higher quantization precision to bands having a higher SMR; and

further assigning quantization precision to each band such that the assigned quantization precision is inversely in proportion to their energy content with respect to band energy to desensitize the bands.

However assigning a higher quantization precision to bands having a higher SMR; and

further assigning quantization precision to each band such that the assigned quantization precision is inversely in proportion to their energy content with respect to band energy to desensitize the bands would have been obvious to one or ordinary skill in the art as there is an obvious tradeoff between emphasizing the audibility of weak bands and the emphasizing the accuracy of strong band signals.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to assign quantization precision based one the signal to mask ratio in order to emphasize bands that might have otherwise been lost is quantization

17. Consider claim 12, Davidson teaches a method for encoding an audio signal, based on a perceptual model, comprising quantization noise shaping of spectral lines on a band-by-band basis using their local gains (Figure 3, step 51 applies a perceptual model to information representing characteristics of the input signal to establish a desired quantization-noise spectrum; column 5, line 20. Subband-signal components are passed to gain element 15 which applies gain factor obtained by analyzer 14; column 6, line 13. The noise levels in this spectrum correspond to the estimated psychoacoustic masking threshold of the input signal; column 5 line 22.), but does not

specifically teach that difference between SMR and SNR is held substantially constant for each band, nor shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios.

In the same field of bit allocation, Hu teaches shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios (In step 412, psycho-acoustic modeler 126 determines signal to mask ratios for the filtered source audio data, and then provides the signal to mask ratios to bit allocator 122; column 5, line 25. In step 416, bit allocator 122 advances to a new current frame. At step 417 the .DELTA.SMR is calculated for each sub-band. This value compares is the difference in SMR for a sub-band as compared to the SMR value for that sub-band in a prior iteration of the loop containing step 417. The sub-band index is advanced at step 418 so that processing of the next (or first) sub-band takes place.; column 5 line 42. This step of comparing the change in SMR's is in fact comparing energy levels, as the SMR is determined in part by the energy levels.).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the bit allocation technique taught by Hu, with the audio encoder of Davidson in order to provide a quantization allocation that more accurately takes advantage of the human perceptual model in order to hide quantization noise more effectively.

This combination does not specifically teach that difference between SMR and SNR is held substantially constant for each band.

However the allocation of figure 3 of Davidson, shows modifying resolution until the noise spectrum is just below the masking threshold for the subband. If this loop is run for each subband, every subband will have a noise spectrum just below the masking threshold, so that the SMR and the SNR are substantially constant for each band.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to make the SMR and the SNR substantially constant in order to provide an efficient encoding scheme, not wasting unnecessary bits to create noise to mask ratios that are unnecessarily large.

18. Consider claim 14, Davidson teaches the method of claim 12, but does not specifically teach the energy ratios are computed by dividing energy in each band over sum of energies in all bands.

However, this energy ratio is merely the percentage of the energy that the band contains for the entire frame, essentially a normalization of the frame.

dealing with the percentage of energy instead of its unnormalized level would be obvious to one of ordinary skill in the art in order to provide a method of quantizing in which each frame has bits distributed in accordance with only the signal level in the frame in question in order to emphasize weaker bands.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use a normalized energy level in calculations in order that bits are assigned based solely on the frame being coded in order to emphasize weaker bands.

19. Consider claim 15, Davidson teaches the method of claim 12, but does not specifically teach wherein shaping quantization noise in each band such that the difference between SMR and SNR is substantially constant comprises:

assigning a higher quantization precision to bands having a higher SMR; and

further assigning quantization precision to each band such that the assigned quantization precision is inversely in proportion to their energy content with respect to band energy to desensitize the bands.

However, assigning a higher quantization precision to bands having a higher SMR and further assigning quantization precision to each band such that the assigned quantization precision is inversely in proportion to their energy content with respect to band energy to desensitize the bands would have been obvious to one or ordinary skill in the art as there is an obvious tradeoff between emphasizing the audibility of weak bands and the emphasizing the accuracy of strong band signals.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to assign quantization precision based one the signal to mask ratio in order to emphasize bands that might have otherwise been lost is quantization.

20. Consider claim 16, Davidson teaches the method of claim 15, wherein fitting the noise shaped spectral lines comprises:

estimating a bit demand for each band (figure 3, step 52 give an initial proposed resolution for quantization); and

allocating the estimated bit demand based on a predetermined bit rate (figure 3 shows a loop for allocating bits to a subband. Step 54 determines whether the total of the required allocations differs significantly from the total number of bits that are available for quantization, column 5, line 38).

21. Consider claim 17, Davidson teaches an apparatus comprising an encoder (figure 1) to quantize an audio signal based on a perceptual model comprising quantization noise shaping of spectral lines on a band-by-band basis and fitting spectral lines within each band based on a given bit rate (Figure 3, step 51 applies a perceptual model to information representing characteristics of the input signal to establish a desired quantization-noise spectrum; column 5, line 20. Subband-signal components are passed to gain element 15 which applies gain factor obtained by analyzer 14; column 6, line 13 The noise levels in this spectrum correspond to the estimated psychoacoustic masking threshold of the input signal; column 5 line 22. Step 54 determines whether the total of the required allocations differs significantly from the total number of bits that are available for quantization, column 5, line 38).

However Davidson does not specifically teach shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios.

In the same field of bit allocation, Hu teaches shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios (In step 412, psycho-acoustic modeler 126 determines signal to

mask ratios for the filtered source audio data, and then provides the signal to mask ratios to bit allocator 122; column 5, line 25. In step 416, bit allocator 122 advances to a new current frame. At step 417 the .DELTA.SMR is calculated for each sub-band. This value compares is the difference in SMR for a sub-band as compared to the SMR value for that sub-band in a prior iteration of the loop containing step 417. The sub-band index is advanced at step 418 so that processing of the next (or first) sub-band takes place; column 5 line 42. This step of comparing the change in SMR's is in fact comparing energy levels, as the SMR is determined in part by the energy levels.).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the bit allocation technique taught by Hu, with the audio encoder of Davidson in order to provide a quantization allocation that more accurately takes advantage of the human perceptual model in order to hide quantization noise more effectively.

22. Consider claim 18, Davidson teaches the apparatus of claim 17, but does not specifically teach that quantization noise shaping the spectral lines on the band-by-band basis comprises:

quantization noise shaping the spectral lines on the band-by-band basis such that the difference between SMR and SNR is substantially constant in each band.

However the allocation of figure 3, shows modifying resolution until the noise spectrum is just below the masking threshold for the subband. If this loop is run for

each subband, every subband will have a noise spectrum just below the masking threshold, so that the SMR and the SNR are substantially constant for each band.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to make the SMR and the SNR substantially constant in order to provide an efficient encoding scheme, not wasting unnecessary bits to create noise to mask ratios that are unnecessarily large.

23. Consider claim 19, Davidson teaches the apparatus of claim 18, wherein the local gains are derived from energy ratios and SMRs in each band (preferably the value of the gain factor is related to the level of the [masking] threshold in some manner; column 6 line 6. A making threshold is in part dependent on the signal energy of the frame. In order to estimate a bit allocation, it is obvious band energy ratios and signal-mask ratios must be considered in order to provide the best allocation to enable a perceived higher quality).

24. Consider claim 21, Davidson teaches an apparatus for coding a signal based on a perceptual model (figure 1), comprising:

means for shaping quantization noise in spectral lines on a band-by-band basis (In FIG. 1, analysis filter bank 12 receives an input signal from path 11, splits the input signal into subband signals representing frequency sub-bands of the input signal; column 4, line 30. Figure 3, step 51 applies a perceptual model to information

representing characteristics of the input signal to establish a desired quantization-noise spectrum; column 5, line 20.); and

means for quantizing the shaped spectral lines in each band based on a predetermined bit rate (quantizer 17).

However Davidson does not specifically teach shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios.

In the same field of bit allocation, Hu teaches shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios (In step 412, psycho-acoustic modeler 126 determines signal to mask ratios for the filtered source audio data, and then provides the signal to mask ratios to bit allocator 122; column 5, line 25. In step 416, bit allocator 122 advances to a new current frame. At step 417 the .DELTA.SMR is calculated for each sub-band. This value compares is the difference in SMR for a sub-band as compared to the SMR value for that sub-band in a prior iteration of the loop containing step 417. The sub-band index is advanced at step 418 so that processing of the next (or first) sub-band takes place; column 5 line 42. This step of comparing the change in SMR's is in fact comparing energy levels, as the SMR is determined in part by the energy levels.).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the bit allocation technique taught by Hu, with the audio encoder of Davidson in order to provide a quantization allocation that more accurately

takes advantage of the human perceptual model in order to hide quantization noise more effectively.

25. Consider claim 22, Davidson teaches the apparatus of claim 21, further comprising:

means for partitioning the signal into a sequence of successive frames (In preferred embodiments, the bank of filters is implemented by weighting or modulating overlapped blocks of digital audio samples with an analysis window function; column 4, line 45);

means for performing time-to-frequency transformation to obtain the spectral lines in each frame (Analysis filter bank 12 may be implemented in a wide variety of ways including polyphase filters, lattice filters, the quadrature mirror filter (QMF), various time-domain-to-frequency-domain block transforms including Fourier-series type transforms, cosine-modulated filter bank transforms and wavelet transforms; column 4 line 40.); and

means for forming bands by grouping neighboring spectral lines within each frame (In FIG. 1, analysis filter bank 12 receives an input signal from path 11, splits the input signal into subband signals representing frequency sub-bands of the input signal... it is common for a split-band encoder and decoder in a perceptual coding system to process many more sub-bands having bandwidths that are commensurate with the critical bandwidths of the human auditory system; column 4, line 30-39).

26. Consider claim 23, Davidson teaches the apparatus of claim 21, wherein the means for quantizing of the spectral lines further comprises:

means for estimating bit demand in each band (figure 3, step 52 give an initial proposed resolution for quantization); and

means for allocating bits based on a predetermined bit rate (figure 3 shows a loop for allocating bits to a subband. Step 54 determines whether the total of the required allocations differs significantly from the total number of bits that are available for quantization, column 5, line 38).

27. Consider claim 24, Davidson teaches the apparatus of claim 21, but does not specifically teach the means for shaping the quantization noise in the spectral lines on a band-by-band basis by using their local gains comprises:

means for shaping quantization noise in the spectral lines such that the difference between SMR and SNR is substantially constant for each band.

However the allocation of figure 3, shows modifying resolution until the noise spectrum is just below the masking threshold for the subband. If this loop is run for each subband, every subband will have a noise spectrum just below the masking threshold, so that the SMR and the SNR are substantially constant for each band.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to make the SMR and the SNR substantially constant in order to provide an efficient encoding scheme, not wasting unnecessary bits to create noise to mask ratios that are unnecessarily large.

28. Consider claim 25, Davidson teaches an audio encoder comprising a quantizer (figure 1, 17) to shape quantization noise in spectral lines in each band (Figure 3, step 51 applies a perceptual model to information representing characteristics of the input signal to establish a desired quantization-noise spectrum; column 5, line 20. Subband-signal components are passed to gain element 15 which applies gain factor obtained by analyzer 14; column 6, line 13.) and to further run a loop to fit the shaped spectral lines in each band within a predetermined bit rate (figure 3 shows a loop for allocating bits to a subband. Step 54 determines whether the total of the required allocations differs significantly from the total number of bits that are available for quantization, column 5, line 38).

However Davidson does not specifically teach shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios.

In the same field of bit allocation, Hu teaches shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios (In step 412, psycho-acoustic modeler 126 determines signal to mask ratios for the filtered source audio data, and then provides the signal to mask ratios to bit allocator 122; column 5, line 25. In step 416, bit allocator 122 advances to a new current frame. At step 417 the .DELTA.SMR is calculated for each sub-band. This value compares is the difference in SMR for a sub-band as compared to the SMR value for that sub-band in a prior iteration of the loop containing step 417. The sub-band index

is advanced at step 418 so that processing of the next (or first) sub-band takes place; column 5 line 42. This step of comparing the change in SMR's is in fact comparing energy levels, as the SMR is determined in part by the energy levels.).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the bit allocation technique taught by Hu, with the audio encoder of Davidson in order to provide a quantization allocation that more accurately takes advantage of the human perceptual model in order to hide quantization noise more effectively.

29. Consider claim 26, Davidson teaches the audio encoder of claim 25, further comprising:

an input module to partition an audio signal into a sequence of successive frames (In preferred embodiments, the bank of filters is implemented by weighting or modulating overlapped blocks of digital audio samples with an analysis window function; column 4, line 45); and

a time-to-frequency transformation module to obtain the spectral lines in each frame, wherein the time-to-frequency transformation module to form bands by grouping neighboring spectral lines with each frame (Analysis filter bank 12 may be implemented in a wide variety of ways including polyphase filters, lattice filters, the quadrature mirror filter (QMF), various time-domain-to-frequency-domain block transforms including Fourier-series type transforms, cosine-modulated filter bank transforms and wavelet transforms; column 4 line 40.).

30. Consider claim 27, Davidson teaches the audio encoder of claim 25, wherein the quantizer comprises:

a noise shaping module to shape the quantization noise in each band (Figure 3, step 51 applies a perceptual model to information representing characteristics of the input signal to establish a desired quantization-noise spectrum. The noise levels in this spectrum correspond to the estimated psychoacoustic masking threshold of the input signal; column 5 line 18-24.); and

an inner loop module to fit shaped band within the predetermined bit rate (Figure 3 shows a loop for allocating bits to a subband. Step 54 determines whether the total of the required allocations differs significantly from the total number of bits that are available for quantization, column 5, line 38),

Davidson does not specifically teach that a difference between SMR and SNR is held substantially constant in each band.

However the allocation of figure 3, shows modifying resolution until the noise spectrum is just below the masking threshold for the subband. If this loop is run for each subband, every subband will have a noise spectrum just below the masking threshold, so that the SMR and the SNR are substantially constant for each band.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to make the SMR and the SNR substantially constant in order to provide an efficient encoding scheme, not wasting unnecessary bits to create noise to mask ratios that are unnecessarily large.

31. Consider claim 28, Davidson teaches an article comprising:

a storage medium having instructions that, when executed by a computing platform, (Figure 13, ROM 94 represents some form of persistent storage such as read only memory (ROM) for storing programs needed to operate device 90 and to carry out various aspects of the present invention.) result in execution of a method comprising:

encoding an audio signal, based on a perceptual model, by noise shaping spectral lines on a band-by-band basis using their local gains (Figure 3, step 51 applies a perceptual model to information representing characteristics of the input signal to establish a desired quantization-noise spectrum; column 5, line 20. Subband-signal components are passed to gain element 15 which applies gain factor obtained by analyzer 14; column 6, line 13. The noise levels in this spectrum correspond to the estimated psychoacoustic masking threshold of the input signal; column 5 line 22.)

Davidson does not specifically teach that the difference between SMR and SNR is held substantially constant for each band.

However the allocation of figure 3, shows modifying resolution until the noise spectrum is just below the masking threshold for the subband. If this loop is run for each subband, every subband will have a noise spectrum just below the masking threshold, so that the SMR and the SNR are substantially constant for each band.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to make the SMR and the SNR substantially constant in order to provide an

efficient encoding scheme, not wasting unnecessary bits to create noise to masking ratios that are unnecessarily large.

32. Consider claim 29, Davidson teaches the article of claim 28, however Davidson does not specifically teach shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios.

In the same field of bit allocation, Hu teaches shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios (In step 412, psycho-acoustic modeler 126 determines signal to mask ratios for the filtered source audio data, and then provides the signal to mask ratios to bit allocator 122; column 5, line 25. In step 416, bit allocator 122 advances to a new current frame. At step 417 the .DELTA.SMR is calculated for each sub-band. This value compares is the difference in SMR for a sub-band as compared to the SMR value for that sub-band in a prior iteration of the loop containing step 417. The sub-band index is advanced at step 418 so that processing of the next (or first) sub-band takes place; column 5 line 42. This step of comparing the change in SMR's is in fact comparing energy levels, as the SMR is determined in part by the energy levels.).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the bit allocation technique taught by Hu, with the audio encoder of Davidson in order to provide a quantization allocation that more accurately takes advantage of the human perceptual model in order to hide quantization noise more effectively.

33. Consider claim 30, Davidson teaches the article of claim 29, but does not specifically teach the energy ratios are computed by dividing energy in each band over sum of energies in all bands.

However, this energy ratio is merely the percentage of the energy that the band contains for the entire frame, essentially a normalization of the frame.

Dealing with the percentage of energy instead of its unnormalized level would be obvious to one of ordinary skill in the art in order to provide a method of quantizing in which each frame has bits distributed in accordance with only the signal level in the frame in question.

34. Consider claim 31, Davidson teaches a system (figure 13) comprising:

a bus (bus 91);

a processor coupled to the bus (DSP 92);

a memory coupled to the processor (RAM 93);

a network interface coupled to the processor and the memory (I/O control 95 represents interface circuitry to receive and transmit audio signals by way of communication channel 96; column 20, line 25); and

an audio encoder (part of DSP 92) comprising a quantizer coupled to the network interface and the processor to shape quantization noise in spectral lines in each band and to further run a loop to fit the shaped spectral lines in each band within a predetermined bit rate (figure 3 shows a loop for allocating bits to a subband. Step 54

determines whether the total of the required allocations differs significantly from the total number of bits that are available for quantization, column 5, line 38).

However Davidson does not specifically teach shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios.

In the same field of bit allocation, Hu teaches shaping quantization noise in the spectral lines by assigning quantization precision based on band energy ratios and Signal-to-mask ratios (In step 412, psycho-acoustic modeler 126 determines signal to mask ratios for the filtered source audio data, and then provides the signal to mask ratios to bit allocator 122; column 5, line 25. In step 416, bit allocator 122 advances to a new current frame. At step 417 the .DELTA.SMR is calculated for each sub-band. This value compares is the difference in SMR for a sub-band as compared to the SMR value for that sub-band in a prior iteration of the loop containing step 417. The sub-band index is advanced at step 418 so that processing of the next (or first) sub-band takes place; column 5 line 42. This step of comparing the change in SMR's is in fact comparing energy levels, as the SMR is determined in part by the energy levels.).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the bit allocation technique taught by Hu, with the audio encoder of Davidson in order to provide a quantization allocation that more accurately takes advantage of the human perceptual model in order to hide quantization noise more effectively.

35. Consider claim 32, Davidson teaches the system of claim 31, further comprising:

an input module to partition an audio signal into a sequence of successive frames (In preferred embodiments, the bank of filters is implemented by weighting or modulating overlapped blocks of digital audio samples with an analysis window function; column 4, line 45); and

a time-to-frequency transformation module to obtain the spectral lines in each frame, wherein the time-to-frequency transformation module to form bands by grouping neighboring spectral lines with each frame (In FIG. 1, analysis filter bank 12 receives an input signal from path 11, splits the input signal into subband signals representing frequency sub-bands of the input signal... it is common for a split-band encoder and decoder in a perceptual coding system to process many more sub-bands having bandwidths that are commensurate with the critical bandwidths of the human auditory system; column 4, line 30-39).

36. Consider claim 33, Davidson teaches the system of claim 32, wherein the quantizer comprises:

a noise shaping module to shape the quantization noise in each band Figure 3, step 51 applies a perceptual model to information representing characteristics of the input signal to establish a desired quantization-noise spectrum. The noise levels in this spectrum correspond to the estimated psychoacoustic masking threshold of the input signal; column 5 line 18-24.); and

an inner loop module to fit shaped band within the predetermined bit rate (Figure 3 shows a loop for allocating bits to a subband. Step 54 determines whether the total of the required allocations differs significantly from the total number of bits that are available for quantization, column 5, line 38).

Davidson does not specifically teach that a difference between SMR and SNR is held substantially constant in each band.

However the allocation of figure 3, shows modifying resolution until the noise spectrum is just below the masking threshold for the subband. If this loop is run for each subband, every subband will have a noise spectrum just below the masking threshold, so that the SMR and the SNR are substantially constant for each band.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to make the SMR and the SNR substantially constant in order to provide an efficient encoding scheme, not wasting unnecessary bits to create noise to mask ratios that are unnecessarily large.

Allowable Subject Matter

37. Claims 11 and 20 are allowed.

38. The following is an examiner's statement of reasons for allowance: The Prior art of record does not teach or fairly suggest alone or in combination the following equations used for deriving local gains:

$$K_b = -(int)(\alpha * log2(en(b)/sum\_en) + \beta * log2(SMR(b)))$$

wherein K6 is the local gain for each band, log2 is logarithm to base 2, en(b) is the band energy in band b, sum en is total energy in a frame, SMR(b) is the psychoacoustic threshold for band b, wherein a measures weightage due to energy ratio, and fl is a weightage due to SMRs.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DOUGLAS C. GODBOLD whose telephone number is (571)270-1451. The examiner can normally be reached on Monday-Thursday 7:00am-4:30pm Friday 7:00am-3:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Patrick Edouard can be reached on (571) 272-7603. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

DCG

/Talivaldis Ivars Smits/
Primary Examiner, Art Unit 2626

3/19/2008